

ABSTRACT

The present invention is directed to methods and apparatuses for performing temporal scanning using ultra-short pulselength lasers in which only minimal (micro-scale) mechanical movement is required. The invention also relates to methods for obtaining high-accuracy timing calibration, on the order of femtoseconds. A dual laser system is disclosed in which the cavity of one or more of the lasers is dithered, by using a piezoelectric element. A Fabry-Perot etalon is used to generate a sequence of timing pulses used in conjunction with a laser beam produced by the laser having the dithered laser cavity. A correlator correlates a laser pulse from one of the lasers with the sequence of timing pulses to produce a calibrated time scale. The methods and apparatuses of the present invention are applicable to many applications requiring rapid scanning and time calibration, including, but not limited to metrology, characterization of charge dynamics in semiconductors, electro-optic testing of ultrafast electronic and optoelectronic devices, optical time domain reflectometry, and electro-optic sampling oscilloscopes.